

Test Plan Update October 2000

Structural Engineering Test Plan

Definition of Structural Engineering

Structural Engineering includes the investigation, evaluation, analysis and design of building and structures such as those listed below to withstand the natural forces of gravity, earthquake, wind and other lateral forces. May also include the preparation of contract documents and construction observation.

- Buildings (new, retrofit, etc.)
- Non building structures (tanks, towers, etc.)
- Bridges and other infrastructures
- Lifelines
- Earth structures (retaining structures etc.)

This area of practice is structured into four primary content areas. The percentage given in parentheses represents the proportion of total test points that will address that test plan area.

- 19% I. Selection of Structural Systems
- 30% II. Analysis of Structures
- 32% III. Design of Structures
- 19% IV. Preparation and Administration of Structural Documents

Glossary of Structural Engineering Terms

Please note that these abilities are grouped and ordered from the least complex abilities to the most complex abilities. That is, analyze, design, and evaluate constitute the most complex abilities in the hierarchy and select, prepare and provide constitute the least complex.

Analyze: To study in detail relationships within a structural engineering project to include internal and external conditions that relate to the project.

Design: Determination of the size and configuration of elements or structure to carry the required forces and loads.

Evaluate: Apply appropriate criteria to assess project requirements.

Determine: The use of a mathematical procedure to establish the status (force, tension, position, etc.) of a point or element in a structure.

Verify: Validate the accuracy of structural information or data to prove that some value, detail or term is logically true.

Perform: To execute and complete a task in accordance with structural engineering principles.

Select: To choose from appropriate structural alternatives.

Provide: Supply information for structural documents.

Prepare: To produce structural documents.

SELECTION OF STRUCTURAL SYSTEMS:

Involves selection of design criteria for new and existing structures, investigation of site conditions for new and existing structure; evaluation of existing structures; and selection of structural systems for new and retrofitted structures.

Objective (Task)	Content Limits (Knowledge)
<i>T1.</i> Evaluate preliminary plans, site conditions, and existing utilities to determine constructability and design constraints of project.	<i>K1.</i> K. of the effect of topographic contours on site that affect constructibility. <i>K2.</i> K. of the effect of soil profiles in selection of foundation systems. <i>K3.</i> K. of the relationship between structure type and permissible foundation settlements. <i>K4.</i> K. of the effect of slope stability, soil cohesiveness, and groundwater tables on structures. <i>K6.</i> K. of techniques to conduct field review of site to identify structural engineering issues. <i>K7.</i> K. of the effect of loads placed adjacent to foundation.
<i>T2./T4.</i> Analyze and determine project and site specific design criteria based on site conditions and applicable codes.	<i>K8.</i> K. of the effect of jurisdiction on applicable building codes and design requirements. <i>K11.</i> K. of code requirements pertaining to minimum uniform and concentrated dead and live floor loads to consider in floor design. <i>K12.</i> K. of code requirements pertaining to minimum uniform and concentrated dead, live and snow roof loads to consider in roof design. <i>K13.</i> K. of code requirements pertaining to slope and camber requirements to ensure adequate drainage of water from structures. <i>K14.</i> K. of code requirements pertaining to criteria for allowable deflection of structural members. <i>K25.</i> K. of seismic separations to accommodate building drift. <i>K26.</i> K. of current code requirements to evaluate historic buildings
<i>T3.</i> Determine foundation and structural design requirements based on information in geotechnical report, e. g., soil profile and site geology.	<i>K1.</i> K. of the effect of topographic contours on site that affect constructibility. <i>K2.</i> K. of the effect of soil profiles in selection of foundation systems. <i>K3.</i> K. of the relationship between structure type and permissible foundation settlements. <i>K4.</i> K. of the effect of slope stability, soil cohesiveness, and groundwater tables on structures. <i>K15.</i> K. of design and performance of slab-on-grade. <i>K22.</i> K. of behavior of different types of building materials under various environmental conditions.

CONTENT AREA ONE: SELECTION OF STRUCTURAL SYSTEMS (19%): Subarea B: Evaluation of Structural Systems Page 2

Involves selection of design criteria for new and existing structures, investigation of site conditions for new and existing structure; evaluation of existing structures; and selection of structural systems for new and retrofitted structures.

Objective (Task)	Content Limits (Knowledge)
<i>T5.</i> Select economically feasible structural system.	<i>K3.</i> K. of the relationship between structure type and permissible foundation settlements. <i>K10.</i> K. of code requirements pertaining to design of a structural system to resist effects of lateral forces. <i>K11.</i> K. of code requirements pertaining to minimum uniform and concentrated dead and live floor loads to consider in floor design. <i>K12.</i> K. of code requirements pertaining to minimum uniform and concentrated dead, live and snow roof loads to consider in roof design. <i>K16.</i> K. of design and performance of concrete structures (reinforced, pre-stressed, tilt-up, etc.). <i>K17.</i> K. of design and performance of masonry structures. <i>K18.</i> K. of design and performance of structural steel structures. <i>K21.</i> K. of design and performance of wood structures. <i>KA.</i> K. of relative material and construction costs.
<i>T6.</i> Select structural system to comply with fire rating, mechanical/electrical systems, and architectural requirements.	<i>K16.</i> K. of design and performance of concrete structures (reinforced, pre-stressed, tilt-up, etc.). <i>K17.</i> K. of design and performance of masonry structures. <i>K18.</i> K. of design and performance of structural steel structures. <i>K21.</i> K. of design and performance of wood structures. <i>K22.</i> K. of behavior of different types of building materials under various environmental conditions. <i>K25.</i> K. of seismic separations to accommodate building drift.
<i>T7.</i> Select the structural system to meet wind and seismic performance requirements.	<i>K5.</i> K. of the effect of wind and seismic factors on design of structural systems. <i>K10.</i> K. of code requirements pertaining to design of a structural system to resist effects of lateral forces. <i>K23.</i> K. of factors to consider in structural design of dual systems for seismic conditions. <i>K24.</i> K. of structural behavior under seismic loads. <i>K25.</i> K. of seismic separations to accommodate building drift. <i>K27.</i> K. of failure mechanisms for different types of structures. <i>K28.</i> K. of different types of strengthening systems to improve structural capacity.

Involves selection of design criteria for new and existing structures, investigation of site conditions for new and existing structure; evaluation of existing structures; and selection of structural systems for new and retrofitted structures.

<p>T8–T10 Evaluate conditions of existing structural systems, members and connections based on observation, analysis and testing.</p>	<p><i>K9.</i> K. of code requirements pertaining to the configuration of a structural system to resist effects of horizontal torsional moments.</p> <p><i>K10.</i> K. of code requirements pertaining to design of a structural system to resist effects of lateral forces.</p> <p><i>K11.</i> K. of code requirements pertaining to minimum uniform and concentrated dead and live floor loads to consider in floor design.</p> <p><i>K12.</i> K. of code requirements pertaining to minimum uniform and concentrated dead, live and snow roof loads to consider in roof design.</p> <p><i>K13.</i> K. of code requirements pertaining to slope and camber requirements to ensure adequate drainage of water from structures.</p> <p><i>K14.</i> K. of code requirements pertaining to criteria for allowable deflection of structural members.</p> <p><i>K15.</i> K. of design and performance of slab-on-grade.</p> <p><i>K16.</i> K. of design and performance of concrete structures (reinforced, pre-stressed, tilt-up, etc.).</p> <p><i>K17.</i> K. of design and performance of masonry structures.</p> <p><i>K18.</i> K. of design and performance of structural steel structures.</p> <p><i>K21.</i> K. of design and performance of wood structures.</p> <p><i>K27.</i> K. of failure mechanisms for different types of structures.</p> <p><i>K28.</i> K. of different types of strengthening systems to improve structural capacity.</p> <p><i>K29.</i> K. of methodologies for inspecting existing structures.</p>
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ANALYSIS OF STRUCTURES:

Involves determination of type, magnitude and load combinations that act on new, retrofitted and non-building structures; determination of external and internal forces generated by loads; and investigation of structural performance under loads.

Objective (Task)	Content Limits (Knowledge)
<i>T11.</i> Determine dead, live and snow loads for structural systems from plans.	<i>K11.</i> K. of code requirements pertaining to minimum uniform and concentrated dead and live floor loads to consider in floor design. <i>K12.</i> K. of code requirements pertaining to minimum uniform and concentrated dead, live and snow roof loads to consider roof design.
<i>T12.</i> Determine lateral forces due to wind and earthquakes.	<i>K30.</i> K. of code-prescribed static lateral force analysis procedures to determine design base shear. <i>K32.</i> K. of code-prescribed static lateral force analysis procedures to determine vertical distribution of seismic forces. <i>K39.</i> K. of procedures to analyze building with horizontal/plan and vertical irregularities. <i>K31.</i> K. of the effect of lateral loads on structural design. <i>K41.</i> K. of code requirements for lateral force design of nonbuilding structures. <i>K44.</i> K. of the effect of wind and seismic loads on design of nonbuilding structures. <i>KB.</i> K. of the effect of lateral force on elements of structures, non-structural components, and equipment supported by structures.
<i>T13.</i> Determine forces due to earth and hydrostatic pressures and other loads.	<i>K43.</i> K. of the effect of earth pressures on design of nonbuilding structures. <i>KC.</i> K. of effect of earth pressures on design of building structures.
<i>T14.</i> Determine governing load combinations for design of structure.	<i>K31.</i> K. of the effect of lateral loads on structural design. <i>K42.</i> K. of the effect of impact loads on nonbuilding structures. <i>K43.</i> K. of the effect of earth pressures on design of nonbuilding structures. <i>K44.</i> K. of the effect of wind and seismic loads on design of nonbuilding structures. <i>KB.</i> K. of the effect of lateral force on elements of structures, non-structural components, and equipment supported by structures. <i>KC.</i> K. of the effect of earth pressures on design of building structures.

CONTENT AREA TWO: ANALYSIS OF STRUCTURES (30%): Subarea B: Lateral Analysis Page 5

Involves determination of type, magnitude and load combinations that act on new, retrofitted and non-building structures; determination of external and internal forces generated by loads; and investigation of structural performance under loads.

Objective (Task)	Content Limits (Knowledge)
<i>T15.</i> Analyze lateral force resisting system to determine deflections and member forces.	<i>K31.</i> K. of the effect of lateral loads on structural design. <i>K33.</i> K. of code-prescribed static lateral force analysis procedures to determine limitations of story drift. <i>K34.</i> K. of code-prescribed dynamic analysis procedures to determine seismic forces. <i>K35.</i> K. of techniques to interpret computer-generated structural analysis output. <i>K36.</i> K. of non-computer methods. <i>K38.</i> K. of modeling techniques for computerized structural analysis programs. <i>K39.</i> K. of procedures to analyze building with horizontal/plan and vertical irregularities. <i>KB.</i> K. of the effect of lateral force on elements of structures, non-structural components, and equipment supported by structures.
<i>T16.</i> Determine deformation compatibility of members not part of lateral force resisting systems.	<i>K33.</i> K. of code-prescribed static lateral force analysis procedures to determine limitations of story drift. <i>KD.</i> K. of code required deformation capability.*
<i>T17.</i> Perform seismic analysis using static procedures.	<i>K33.</i> K. of code-prescribed static lateral force analysis procedures to determine limitations of story drift. <i>K35.</i> K. of techniques to interpret computer-generated structural analysis output. <i>K36.</i> K. of non-computer methods. <i>K38.</i> K. of modeling techniques for computerized structural analysis programs. <i>K39.</i> K. of procedures to analyze building with horizontal/plan and vertical irregularities. <i>K41.</i> K. of code requirements for lateral force design of nonbuilding structures. <i>K44.</i> K. of the effect of wind and seismic loads on design of nonbuilding structures. <i>KB.</i> K. of the effect of lateral force on elements of structures, non-structural components, and equipment supported by structures.
<i>T18.</i> Perform seismic dynamic analysis using response spectra method.	<i>K33.</i> K. of code-prescribed static lateral force analysis procedures to determine limitations of story drift. <i>K34.</i> K. of code-prescribed dynamic analysis procedures to determine seismic forces. <i>K35.</i> K. of techniques to interpret computer-generated structural analysis output. <i>K36.</i> K. of non-computer methods. <i>K38.</i> K. of modeling techniques for computerized structural analysis programs. <i>K39.</i> K. of procedures to analyze building with horizontal/plan and vertical irregularities. <i>K41.</i> K. of code requirements for lateral force design of nonbuilding structures. <i>K44.</i> K. of the effect of wind and seismic loads on design of nonbuilding structures. <i>KB.</i> K. of the effect of lateral force on elements of structures, non-structural components, and equipment supported by structures.
<i>T19.</i> Determine forces, stresses, and deflections/displacements of horizontal diaphragms.	<i>K37.</i> K. of non-computer methods to determine shears and moments in continuous spans. <i>K39.</i> K. of procedures to analyze building with horizontal/plan and vertical irregularities. <i>K40.</i> K. of code-prescribed procedures to analyze diaphragms.

CONTENT AREA TWO: ANALYSIS OF STRUCTURES (30%): Subarea B: Lateral Analysis Page 6

Involves determination of type, magnitude and load combinations that act on new, retrofitted and non-building structures; determination of external and internal forces generated by loads; and investigation of structural performance under loads.

<i>T20.</i> Verify accuracy of computer-generated output by hand calculations <i>or</i> other non computer methods.	<i>K35.</i> K. of techniques to interpret computer-generated structural analysis output. <i>K36.</i> K. of non-computer methods. <i>K38.</i> K. of modeling techniques for computerized structural analysis programs.
<i>T21.</i> Perform nonlinear analysis to determine structural response.	<i>K31.</i> K. of the effect of lateral loads on structural design. <i>K34.</i> K. of code-prescribed dynamic analysis procedures to determine seismic forces. <i>K35.</i> K. of techniques to interpret computer-generated structural analysis output. <i>K36.</i> K. of non-computer methods. <i>K38.</i> K. of modeling techniques for computerized structural analysis programs.

DESIGN OF STRUCTURES:

Involves design of elements and connections for new, retrofitted, and nonbuilding structures using a variety of materials such as steel, concrete, wood and masonry.

Objective (Task)	Content Limits (Knowledge)
T22. Design structural elements and connections using steel.	<p>K45. K. of standards for material properties and specifications.</p> <p>K46. K. of code requirements pertaining to working stress design to accommodate different load combinations.</p> <p>K48. K. of code requirements pertaining to load factors and load combinations for load resistance factor design in steel construction.</p> <p>K49. K. of code requirements pertaining to anchorage of a structural system to resist uplift and sliding forces.</p> <p>K50. K. of code requirements pertaining to discontinuous lateral force resisting elements.</p> <p>K52. K. of methods to mitigate the effect of floor vibrations.</p> <p>K53. K. of design procedures for steel moment frames.</p> <p>K54. K. of design procedures for steel moment connections.</p> <p>K55. K. of design procedures for steel baseplates.</p> <p>K56. K. of design procedures for cold-formed steel.</p> <p>K57. K. of design procedures for steel columns.</p> <p>K58. K. of design procedures for steel beam-columns.</p> <p>K59. K. of design procedures for steel plate girders.</p> <p>K60. K. of design procedures for steel beams.</p> <p>K61. K. of design procedures for steel bracing.</p> <p>K62. K. of design procedures for steel tension members.</p> <p>K63. K. of design procedures for simple, partially rigid, rigid, welded, and bolted connections.</p> <p>K64. K. of design procedures for composite steel design.</p> <p>K65. K. of design procedures for steel decking.</p>
T23. Design structural elements and connections using concrete.	<p>K45. K. of standards for material properties and specifications.</p> <p>K46. K. of code requirements pertaining to working stress design to accommodate different load combinations.</p> <p>K47. K. of code requirements pertaining to load factors and load combinations for strength design in concrete construction.</p> <p>K49. K. of code requirements pertaining to anchorage of a structural system to resist uplift and sliding forces.</p> <p>K50. K. of code requirements pertaining to discontinuous lateral force resisting elements.</p> <p>K51. K. of code requirements pertaining to foundation soil-structure interaction.</p> <p>K52. K. of methods to mitigate the effect of floor vibrations.</p> <p>K66. K. of design procedures for concrete foundations (two-way slab, pre-tensioned, post-tensioned concrete).</p> <p>K67. K. of design procedures for concrete flexural members.</p> <p>K68. K. of design procedures for concrete compression members.</p> <p>K69. K. of design procedures for concrete flexural-compression members.</p> <p>K70. K. of design procedures for concrete shear walls.</p> <p>K71. K. of ductile detailing in concrete structures with special moment resisting frames.</p> <p>K72. K. of design procedures for two-way slab systems.</p> <p>K73. K. of standards for concrete reinforcing bar details.</p> <p>K74. K. of design procedures for pretensioned concrete.</p> <p>K75. K. of design procedures for post-tensioned concrete.</p> <p>K76. K. of design procedures for attachment of elements to concrete.</p> <p>K77. K. of design procedures for concrete diaphragms.</p>

DESIGN OF STRUCTURES:

Involves design of elements and connections for new, retrofitted, and nonbuilding structures using a variety of materials such as steel, concrete, wood and masonry.

<p><i>T24.</i> Design structural elements and connections using wood</p>	<p><i>K45.</i> K. of standards for material properties and specifications. <i>K46.</i> K. of code requirements pertaining to working stress design to accommodate different load combinations. <i>K49.</i> K. of code requirements pertaining to anchorage of a structural system to resist uplift and sliding forces. <i>K50.</i> K. of code requirements pertaining to discontinuous lateral force resisting elements. <i>K52.</i> K. of methods to mitigate the effect of floor vibrations. <i>K76.</i> K. of design procedures for attachment of elements to concrete. <i>K78.</i> K. of design procedures for wood trusses. <i>K79.</i> K. of design procedures for sawn wood beams. <i>K80.</i> K. of design procedures for glue-laminated wood beams. <i>K81.</i> K. of design procedures for wood columns. <i>K82.</i> K. of design procedures for plywood diaphragms. <i>K83.</i> K. of design procedures for wood bearing walls. <i>K84.</i> K. of design procedures for wood shear walls. <i>K85.</i> K. of design procedures for bolted, screwed and nailed connections in wood design. <i>K91.</i> K. of design procedures for attachment of elements to masonry.</p>
<p><i>T25.</i> Design structural elements and connections using masonry.</p>	<p><i>K45.</i> K. of standards for material properties and specifications. <i>K46.</i> K. of code requirements pertaining to working stress design to accommodate different load combinations. <i>K49.</i> K. of code requirements pertaining to anchorage of a structural system to resist uplift and sliding forces. <i>K50.</i> K. of code requirements pertaining to discontinuous lateral force resisting elements. <i>K76.</i> K. of design procedures for attachment of elements to concrete. <i>K86.</i> K. of design procedures for masonry flexural members. <i>K87.</i> K. of design procedures for masonry compression members. <i>K88.</i> K. of design procedures for masonry flexural-compression members. <i>K89.</i> K. of design procedures for masonry bearing walls. <i>K90.</i> K. of design procedures for masonry shear walls. <i>K91.</i> K. of design procedures for attachment of elements to masonry.</p>

DESIGN OF STRUCTURES:

Involves design of elements and connections for new, retrofitted, and nonbuilding structures using a variety of materials such as steel, concrete, wood and masonry.

<p><i>T26.</i> Design structural elements and connections to meet special seismic requirements.</p>	<p><i>K45.</i> K. of standards for material properties and specifications. <i>K46.</i> K. of code requirements pertaining to working stress design to accommodate different load combinations. <i>K47.</i> K. of code requirements pertaining to load factors and load combinations for strength design in concrete construction. <i>K48.</i> K. of code requirements pertaining to load factors and load combinations for load resistance factor design in steel construction. <i>K49.</i> K. of code requirements pertaining to anchorage of a structural system to resist uplift and sliding forces. <i>K50.</i> K. of code requirements pertaining to discontinuous lateral force resisting elements. <i>K53.</i> K. of design procedures for steel moment frames. <i>K54.</i> K. of design procedures for steel moment connections. <i>K55.</i> K. of design procedures for steel baseplates. <i>K63.</i> K. of design procedures for simple, partially rigid, rigid, welded, and bolted connections. <i>K64.</i> K. of design procedures for composite steel design. <i>K65.</i> K. of design procedures for steel decking. <i>K67.</i> K. of design procedures for concrete flexural members. <i>K69.</i> K. of design procedures for concrete flexural-compression members. <i>K71.</i> K. of ductile detailing in concrete structures with special moment resisting frames. <i>K73.</i> K. of standards for concrete reinforcing bar details. <i>K77.</i> K. of design procedures for concrete diaphragms. <i>K82.</i> K. of design procedures for plywood diaphragms. <i>K84.</i> K. of design procedures for wood shear walls. <i>K85.</i> K. of design procedures for bolted, screwed and nailed connections in wood design. <i>K88.</i> K. of design procedures for masonry flexural-compression members. <i>K90.</i> K. of design procedures for masonry shear walls. <i>K91.</i> K. of design procedures for attachment of elements to masonry. <i>KB.</i> K. of the effect of lateral force on elements of structures, non-structural components, and equipment supported by structures.</p>
<p><i>T28.</i> Design horizontal diaphragm members and their connection details.</p>	<p><i>K45.</i> K. of standards for material properties and specifications. <i>K46.</i> K. of code requirements pertaining to working stress design to accommodate different load combinations. <i>K47.</i> K. of code requirements pertaining to load factors and load combinations for strength design in concrete construction. <i>K48.</i> K. of code requirements pertaining to load factors and load combinations for load resistance factor design in steel construction. <i>K50.</i> K. of code requirements pertaining to discontinuous lateral force resisting elements. <i>K58.</i> K. of design procedures for steel beam-columns. <i>K63.</i> K. of design procedures for simple, partially rigid, rigid, welded, and bolted connections. <i>K65.</i> K. of design procedures for steel decking. <i>K69.</i> K. of design procedures for concrete flexural-compression members. <i>K77.</i> K. of design procedures for concrete diaphragms. <i>K82.</i> K. of design procedures for plywood diaphragms. <i>K85.</i> K. of design procedures for bolted, screwed and nailed connections in wood design. <i>K91.</i> K. of design procedures for attachment of elements to masonry.</p>

DESIGN OF STRUCTURES:

Involves design of elements and connections for new, retrofitted, and nonbuilding structures using a variety of materials such as steel, concrete, wood and masonry.

<p><i>T30.</i>Design connections between structural elements and foundation.</p>	<p><i>K45.</i> K. of standards for material properties and specifications. <i>K46.</i> K. of code requirements pertaining to working stress design to accommodate different load combinations. <i>K47.</i> K. of code requirements pertaining to load factors and load combinations for strength design in concrete construction. <i>K48.</i> K. of code requirements pertaining to load factors and load combinations for load resistance factor design in steel construction. <i>K49.</i> K. of code requirements pertaining to anchorage of a structural system to resist uplift and sliding forces. <i>K51.</i> K. of code requirements pertaining to foundation soil-structure interaction. <i>K55.</i> K. of design procedures for steel baseplates. <i>K61.</i> K. of design procedures for steel bracing. <i>K66.</i> K. of design procedures for concrete foundations (two-way slab, pre-tensioned, post-tensioned concrete). <i>K71.</i> K. of ductile detailing in concrete structures with special moment resisting frames. <i>K76.</i> K. of design procedures for attachment of elements to concrete. <i>K84.</i> K. of design procedures for wood shear walls. <i>K85.</i> K. of design procedures for bolted, screwed and nailed connections in wood design. <i>K90.</i> K. of design procedures for masonry shear walls. <i>K91.</i> K. of design procedures for attachment of elements to masonry.</p>
<p><i>T31.</i> Design foundation systems.</p>	<p><i>K45.</i> K. of standards for material properties and specifications. <i>K46.</i> K. of code requirements pertaining to working stress design to accommodate different load combinations. <i>K47.</i> K. of code requirements pertaining to load factors and load combinations for strength design in concrete construction. <i>K49.</i> K. of code requirements pertaining to anchorage of a structural system to resist uplift and sliding forces. <i>K51.</i> K. of code requirements pertaining to foundation soil-structure interaction. <i>K66.</i> K. of design procedures for concrete foundations (two-way slab, pre-tensioned, post-tensioned concrete). <i>KE.</i> K. of design procedures for pile foundations. <i>KF.</i> K. of design procedures for wood foundations.</p>

DESIGN OF STRUCTURES:

Involves design of elements and connections for new, retrofitted, and nonbuilding structures using a variety of materials such as steel, concrete, wood and masonry.

<p><i>T33.</i> Design above ground nonbuilding structures.</p>	<p><i>K45.</i> K. of standards for material properties and specifications. <i>K46.</i> K. of code requirements pertaining to working stress design to accommodate different load combinations. <i>K47.</i> K. of code requirements pertaining to load factors and load combinations for strength design in concrete construction. <i>K48.</i> K. of code requirements pertaining to load factors and load combinations for load resistance factor design in steel construction. <i>K49.</i> K. of code requirements pertaining to anchorage of a structural system to resist uplift and sliding forces. <i>K50.</i> K. of code requirements pertaining to discontinuous lateral force resisting elements. <i>K52.</i> K. of methods to mitigate the effect of floor vibrations. <i>K53.</i> K. of design procedures for steel moment frames. <i>K54.</i> K. of design procedures for steel moment connections. <i>K55.</i> K. of design procedures for steel baseplates. <i>K56.</i> K. of design procedures for cold-formed steel. <i>K57.</i> K. of design procedures for steel columns. <i>K58.</i> K. of design procedures for steel beam-columns. <i>K59.</i> K. of design procedures for steel plate girders. <i>K60.</i> K. of design procedures for steel beams. <i>K61.</i> K. of design procedures for steel bracing. <i>K62.</i> K. of design procedures for steel tension members. <i>K63.</i> K. of design procedures for simple, partially rigid, rigid, welded, and bolted connections. <i>K64.</i> K. of design procedures for composite steel design. <i>K65.</i> K. of design procedures for steel decking. <i>K67.</i> K. of design procedures for concrete flexural members. <i>K68.</i> K. of design procedures for concrete compression members. <i>K69.</i> K. of design procedures for concrete flexural-compression members. <i>K70.</i> K. of design procedures for concrete shear walls. <i>K71.</i> K. of ductile detailing in concrete structures with special moment resisting frames. <i>K72.</i> K. of design procedures for two-way slab systems. <i>K73.</i> K. of standards for concrete reinforcing bar details. <i>K76.</i> K. of design procedures for attachment of elements to concrete. <i>K77.</i> K. of design procedures for concrete diaphragms. <i>K78.</i> K. of design procedures for wood trusses. <i>K79.</i> K. of design procedures for sawn wood beams. <i>K80.</i> K. of design procedures for glue-laminated wood beams. <i>K81.</i> K. of design procedures for wood columns. <i>K82.</i> K. of design procedures for plywood diaphragms. <i>K83.</i> K. of design procedures for wood bearing walls. <i>K84.</i> K. of design procedures for wood shear walls. <i>K85.</i> K. of design procedures for bolted, screwed and nailed connections in wood design. <i>K86.</i> K. of design procedures for masonry flexural members. <i>K87.</i> K. of design procedures for masonry compression members. <i>K88.</i> K. of design procedures for masonry flexural-compression members.</p>
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DESIGN OF STRUCTURES:

Involves design of elements and connections for new, retrofitted, and nonbuilding structures using a variety of materials such as steel, concrete, wood and masonry.

<i>T33.</i> Design above ground nonbuilding structures (continued)	<i>K89.</i> K. of design procedures for masonry bearing walls. <i>K90.</i> K. of design procedures for masonry shear walls. <i>K91.</i> K. of design procedures for attachment of elements to masonry. <i>KG.</i> K. of special design requirements for non-building structures and equipment.
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PREPARATION AND ADMINISTRATION OF STRUCTURAL DOCUMENTS:

Involves preparation of design specification; structural drawings and details; review of fabrication documents; and consideration of construction issues.

<p><i>T27.</i> Design connections between elements of structures, non-structural components and equipment supported by structures.</p>	<p><i>K45.</i> K. of standards for material properties and specifications. <i>K46.</i> K. of code requirements pertaining to working stress design to accommodate different load combinations. <i>K47.</i> K. of code requirements pertaining to load factors and load combinations for strength design in concrete construction. <i>K48.</i> K. of code requirements pertaining to load factors and load combinations for load resistance factor design in steel construction. <i>K56.</i> K. of design procedures for cold-formed steel. <i>K63.</i> K. of design procedures for simple, partially rigid, rigid, welded, and bolted connections. <i>K76.</i> K. of design procedures for attachment of elements to concrete. <i>K85.</i> K. of design procedures for bolted, screwed and nailed connections in wood design. <i>K91.</i> K. of design procedures for attachment of elements to masonry.</p>
<p><i>T29.</i> Design connections between dissimilar materials.</p>	<p><i>K45.</i> K. of standards for material properties and specifications. <i>K51.</i> K. of code requirements pertaining to foundation soil-structure interaction. <i>K55.</i> K. of design procedures for steel baseplates. <i>K56.</i> K. of design procedures for cold-formed steel. <i>K57.</i> K. of design procedures for steel columns. <i>K58.</i> K. of design procedures for steel beam-columns. <i>K60.</i> K. of design procedures for steel beams. <i>K73.</i> K. of standards for concrete reinforcing bar details. <i>K74.</i> K. of design procedures for pretensioned concrete. <i>K76.</i> K. of design procedures for attachment of elements to concrete. <i>K79.</i> K. of design procedures for sawn wood beams. <i>K81.</i> K. of design procedures for wood columns. <i>K85.</i> K. of design procedures for bolted,screwed and nailed connections in wood design. <i>K91.</i> K. of design procedures for attachment of elements to masonry.</p>
<p><i>T32.</i> Prepare design details for expansion joints.</p>	<p><i>K45.</i> K. of standards for material properties and specifications. <i>K63.</i> K. of design procedures for simple, partially rigid, rigid, welded, and bolted connections. <i>K66.</i> K. of design procedures for concrete foundations (two-way slab, pre-tensioned, post-tensioned concrete). <i>K73.</i> K. of standards for concrete reinforcing bar details. <i>K76.</i> K. of design procedures for attachment of elements to concrete. <i>K85.</i> K. of design procedures for bolted, screwed and nailed connections in wood design. <i>K91.</i> K. of design procedures for attachment of elements to masonry.</p>

Involves preparation of design specifications; structural drawings and details; review of fabrication documents; and consideration of construction issues.

Objective (Task)	Content Limits (Knowledge)
T34. Provide member sizes, dimensions and details to prepare structural drawings for construction.	K92. K. of engineering information required for preparing construction specifications. K93. K. of engineering information required to develop construction drawings and details. K94. K. of construction sequencing to satisfy design criteria. K96. K. of techniques to evaluate alternate construction procedures. K97. K. of procedures to implement contractor-requested changes to the structural documents.
T35. Prepare seismic force resisting system details for structural drawings.	K92. K. of engineering information required for preparing construction specifications. K93. K. of engineering information required to develop construction drawings and details. K94. K. of construction sequencing to satisfy design criteria. K96. K. of techniques to evaluate alternate construction procedures. K97. K. of procedures to implement contractor-requested changes to the structural documents.
T36. Prepare specifications, testing and inspection requirements for structural systems to satisfy design criteria.	K92. K. of engineering information required for preparing construction specifications. K93. K. of engineering information required to develop construction drawings and details. K95. K. of requirements for testing and inspection criteria. K98. K. of testing and inspection procedures to verify conformance with design criteria.
T37. Verify shop drawings and submittals for complex details or changes to ensure compliance with design criteria.	K5. K. of the effect of wind and seismic factors on design of structural systems. K10. K. of code requirements pertaining to design of a structural system to resist effects of lateral forces. K23. K. of factors to consider in structural design of dual systems for seismic conditions. K24. K. of structural behavior under seismic loads. K25. K. of seismic separations to accommodate building drift. K27. K. of failure mechanisms for different types of structures. K28. K. of different types of strengthening systems to improve structural capacity.
T38. Provide resolution for structural issues that occur during construction.	K5. K. of the effect of wind and seismic factors on design of structural systems. K24. K. of structural behavior under seismic loads. K25. K. of seismic separations to accommodate building drift. K27. K. of failure mechanisms for different types of structures. K28. K. of different types of strengthening systems to improve structural capacity. K92. K. of engineering information required for preparing construction specifications. K94. K. of construction sequencing to satisfy design criteria. K95. K. of requirements for testing and inspection criteria. K96. K. of techniques to evaluate alternate construction procedures. K97. K. of procedures to implement contractor-requested changes to the structural documents. K99. K. of procedures for mitigating nonconforming work.
T39. Prepare construction documents for structural upgrades/retrofit to improve performance of the structure.	K92. K. of engineering information required for preparing construction specifications. K93. K. of engineering information required to develop construction drawings and details. K94. K. of construction sequencing to satisfy design criteria. K95. K. of requirements for testing and inspection criteria. K96. K. of techniques to evaluate alternate construction procedures. K97. K. of procedures to implement contractor-requested changes to the structural documents. K98. K. of testing and inspection procedures to verify conformance with design criteria. K99. K. of procedures for mitigating nonconforming work.